similar to the adjacent spinal tissue, confirming that spinal cord tissue elements are integrated to the porour network of the hydrogel.

TEST 2

The cryopolymerisation procedure allowed to generate heterogeneous gels with fixed macroporous structure into which cells are immobilized. Studies using cell labeling technique, such as cell labeling or immunocytochemistry, show that the cells are uniformly distributed throughout the polymer network and at different levels within the gels, either as individual isolated cells or arranged in small clusters of a few cells. The cells which survive were positively immunostained throughout three weeks in vitro incubation with antigenic profiles of developing neural tissue cells. Hence, astrocytes isolated from the neonatal brain of rats can be trapped within hydrophilic hydrogels by cryopolymerization reaction with high levels of retention and the entrapped cells can survive and normally differentiate as they do in monolayer culture conditions: after 10 days in vitro, the viability of entrapped cells is of 90% using cell labeling techniques. In addition, the cells are functional as they synthesize laminin and fibronectin within the polymer matrix as they do in monolayer cultures.

It is understood that the present invention is not limited to the preferred embodiments described above and that modifications are possible without departing from the spirit and scope of the present invention.

I claim:

1. A polymer hydrogel for therapeutic use, comprising:

a copolymer of (a) and N-substituted methacrylamide or acrylamide, (b) a cross-linking agent and (c) at least one type of copolymerizable, biologically active molecule, which is a complex sugar, a sugar derivative or a tissue adhesive peptide, said polymer hydrogel being heterogeneous, elastically deformable and having an equilibrium water content of at least about 80%, a fractional porosity of at least 80–90%, a mean pore diameter of about 15–35 μm and a porous volume of pores measuring at least 10 μm equal to substantially 100% of the total fractional porosity of the hydrogel.

2. The polymer hydrogel of claim **1**, wherein (a) said N-substituted methacrylamide or acrylamide is selected from the group consisting of N-monoalkyl and N,N-dialkylmethacrylamides and acrylamides, (b) said cross-linking agent is acrylamide or precursors thereof, and (c) said copolymerizable, biologically active molecule, which is tissue adhesive, is glucosamine, N-acetylglucosamine or an N-acetyl derivative of neuraminic acid.

3. The ploymer hydrogel of claim **2**, wherein said alkyl group contains 1–2 carbon atoms.

4. The polymer hydrogel of claim **3**, wherein said alkyl is a hydroxyalkyl or an aminoalkyl.

5. The polymer hydrogel of claim **1**, wherein said equilibrium water content is at least 96%.

6. The polymer hydrogel of claim **1**, wherein said hydrogel is covalently cross-linked and substantially non-transparent.

7. The polymer hydrogel of claim **6**, wherein said hydrogel shows a clear phase separated structure formed of polymer particles of about 1–10 μm, thereby providing an area of relatively coarse porosity where the hydrogel is intended to interface with a host tissue and of relatively fine porosity where it is intended to interface with ingrowing tissue.

8. The polymer hydrogel of claim **1**, which has a specific surface area of at least 100 m^2/gram and a hyperporous character in the range of 20 to 30 μm.

9. A method for preparing a heterogeneous, elastically deformable hydrogel for therapeutic use, which comprises:

(a) dissolving a cross-linking agent in a solvent with a free radical polymerization initiator selected from the group consisting of azobisisobutyronitrile, a peroxide, ascorbic acid, a peroxysulfate or a substituted azo compound, said initiator being present in an amount ranging from 0.01–2% by weight with respect to the polymer hydrogel which is formed, to form a solution;

(b) adding an N-substituted methacrylamide or acrylamide to the solution obtained in (a) to form a mixture,

(c) adding a solution of a copolymerizable, biologically active molecule, which is a complex sugar, a sugar derivative or a tissue adhesive peptide, to said solution; and

(d) polymerizing the components (a) to (c), thereby obtaining a polymer hydrogel which is heterogeneous, elastically deformable and has an equilibrium water content of at least about 80%, a fractional porosity of at least 80–90%, a mean pore diameter of about 15–25 μm and a porous volume of pores measuring at least 10 μm equal to substantially 100% of the total fractional porosity of the hydrogel.

10. The method of claim **9**, which comprises:

dissolving azobisisobutyronitrile and methylene bisacrylamide in said solvent, thereby forming a solution;

mixing said solution with N-(2-hydroxypropyl) methacrylamide;

adding glucosamine or N-actylglucosamine or N-acetylneuraminic acid thereto;

polymerizing the monomer mixture; and

removing low molecular weight residual products and initiator traces therefrom.

11. The method of claim **9**, wherein said cross-linking agent is acrylamide, precursors thereof or diving cross-linking agents.

12. The method of claim **9**, wherein said complex sugar is glucosamine, N-acetylglucosamine, N-acetyl derivatives of neuraminic acid, polysialic acid or galactosamine derivatives.

13. The method of claim **9**, wherein said solution of polymerizable material comprises at least one type of tissue adhesion peptide.

14. The method of claim **9** wherein the copolymerization reaction is conducted at a temperature ranging from 40°–60° C. for about 12 hours.

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